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Claims

1 A thermoforming apparatus comprising

- a thermoforming machine (10) fitted with at least one female die (12) and counter-die or male die (13) reciprocally approachable and removable for the operations of closing, thermoforming and opening, a feeder appropriate for feeding thermoforming material [in ribbon or plate (14)] from between each female die (12) and counter-die (13),
- cutting means associated with the die and counter-die for cutting the ribbon or plate material, immediately after the closure of the die (12) and counter-die (13),
- at least one [work or treatment station] for articles (15) thermoformed in the or each die (12) or counter-die (13),
- extraction pick-up means (16) designed to withdraw a thermoformed article [moulding] from the female die (12) and (either) to convey (the same) to at least one work or treatment station (or) to transfer it to a receiving conveying template (17)] which has the same seating configuration as that of the female die (12) and is arranged to move the thermoformed articles (15) past at least one work or treatment station,
- **characterised in that** (retention means) are provided in the said extraction pick-up means (and/or) in the said receiving conveying template to hold (them) in position against undesired movement therein.

2. A thermoforming apparatus as claimed in Claim 1, characterised in that the said pick-up extraction means comprises a plate-like head (16) arranged to be sequentially inserted between [the or] each female die (12) and counter-die (13)] concomitantly with each opening of the same.

3. A thermoforming apparatus as claimed in Claim 2, [characterised in that] it comprises a carousel conveyor (20) with a plurality of bearing arms, each of which supports (a) respective (plate-like head) (17) fitted with said retention means for the retention of the thermoformed articles (15) in the correct set while they are being conveyed, stepwise and synchronously with (the) opening-closing rate of the dies

(12), through the work or treatment station or stations, positioned around the carousel conveyor.

4. An apparatus as claimed in Claim 3, characterised in that the said retention means for each plate-shaped extraction head (17) comprises a hole or seat through the said plate-shaped extraction head for each thermoformed article to be extracted, each hole being machined along its thickness to obtain two annular surfaces reamed in opposite directions and delimiting between them an equatorial shoulder (16d) with a slightly undercut, internal angle of incidence, in order to allow insertion by the thrust of a rimmed thermoformed article (15) and enable it to be resiliently constrained and held firmly in position at its rim.

5. A thermoforming apparatus as claimed in Claim 2, characterized in that it comprises a chain or chains conveyor (24) each wound by a pair of chain wheels and having a run (27) thereof extending along the respective die (12) or counter-die (13) but beyond the encumbrance thereof, a plurality of extraction plates (16) carried at predetermined intervals from each other on the said conveyor (24) and each fitted with the said retention means for retaining the thermoformed articles (15) in the proper set during their conveyance.

6. A thermoforming apparatus as claimed in Claim 1 ~~or 2~~, characterized in that it comprises a template conveyor (24) extending through the work or treatment station or stations and moving stepwise at the opening-closure rate of the dies (12) for receiving a moulding or thermoformed articles (15) from an extraction plate (16) and conveying them in sequence to the work or treatment station or stations along the template conveyor (24).

7. A thermoforming apparatus as claimed in Claim 6, characterized in that the said template conveyor (24)

comprises two alternately movable templates (17), once on one side of the die (12) and once on the other, so that a template (17) is moved laterally in relation to the female die (12) at a work or treatment station, while the other one is in front of it to receive an article moulding from the extraction plate (16).

8. A thermoforming apparatus as claimed in Claim 6, characterized in that the said template conveyor (24) is a chain or chains conveyor which comprises a pair of chain wheels (26) around which the or a respective chain (25) is wound, a plurality of plate-like templates (17) carried, spaced at a predetermined distance from each other, on the said conveyor (24) and each fitted with the said retention means for retaining the thermoformed articles (15) in the proper set during their conveyance.

9. A thermoforming apparatus as claimed in Claim 5, characterized in that the said template conveyor (24) comprises a train of articulated bearing slides (32) or carriages (33) for a respective template (17) moving through the work or treatment station or stations.

10. A thermoforming apparatus as claimed in claim 6 ~~in any of Claims 6 to 9~~, characterised in that the said retention means on each template comprises a truncated conical collar (38) seated in each receiving hole for precise location of a respective thermoformed article (15) on the surface of each template (17) facing the extraction plate of plates (16).

11. A thermoforming apparatus as claimed in Claim 10, characterised in that the said collar (38) is constituted of resiliently deformable material suitable for exerciting a moderate retentive pressure on the external surface of a thermoformed article (15).

12. A thermoforming apparatus as claimed in Claim 10, characterised in that the said collar (38) comprises a

plurality of resiliently loaded ratchets (48), installed in said collar and movable towards its internal diameter for engaging with the external surface of a thermoformed article (15) in a respective receiving seat.

13. A thermoforming apparatus as claimed in Claim 10, characterised in that the said collar (38) comprises suction orifices which exert on the thermoformed article (15) a suction action to hold it in the proper set in its respective receiving seat and with its rim abutting against the template (17).

14. A thermoforming apparatus as claimed in ~~any of Claims 10 to 13~~ claim 10, characterised in that each template (17) at each flanged receiving set for thermoformed rimmed articles (15) has a peripheral recess formed on the surface of the template (17) facing the extraction plate or plates (16) for engaging the rim of a respective article (15) installed in it.

15. A thermoforming apparatus as claimed in ~~any of Claims 6 to 9~~ claim 6, characterised in that the said retention means for each template (17) comprises a two-diameter adaptor collar (39) installable in each receiving seat and having an internal diameter delimited by a tapered under section, and undercut intermediate section with a negative angle α, an annular shoulder downstream of the undercut section, to be able to receive from above a flanged thermoformed article (15) and snap-engage its rim at is undercut.

16. A thermoforming apparatus as claimed in ~~any of Claims 6 to 9~~ claim 6, characterised in that the said retention means for each template (17) comprises receiving holes for the thermoformed articles lower portion, but with a slightly smaller internal diameter than the external dimensions of the thermoformed articles (15) to be received close to its rim, so that the thermoformed article (15) is resiliently

constrained and then steadily bedded in the respective receiving hole.

17. A thermoforming apparatus as claimed in ~~any of Claims 6 to 9~~ claim 6, characterised in that the said retention means of each template (17) comprises eccentric mechanical arrests (50), each of which is fitted at a respective receiving hole of a template (17) and is movable between an operating position in which it engages the rim of a flanged thermoformed article (15) and an inoperative releasing position.

18. A thermoforming apparatus as claimed in Claim 17, characterised in that the said arrests are controlled by a rack operated by a suitable motion source.

19. A thermoforming apparatus as claimed in ~~any of Claims 6 to 9~~ claim 6, characterised in that the said retention means comprises air jets (53) for sinking each of the articles (15) into the receiving holes on each template (17).

20. A thermoforming apparatus as claimed in ~~any of Claims 6 to 9~~ claim 6, characterised in that the said retention means comprises a cup-shaped receiving component (54, 61) for a thermoformed article (15) having at least one orifice in its base.

21. A thermoforming apparatus as claimed in Claim 21, characterised in that it comprises a push rod (56) for expelling the thermoformed article (15) from the cup-shaped component (54, 61) by acting through at least one orifice (55) in the bottom of the cup-shaped component.

22. A thermoforming apparatus as claimed in ~~any one of Claims 6 to 9~~ claim 6, characterised in that the said retention means comprises a support shoulder for shallow, thermoformed articles arranged between each receiving seat of the template (17), the said shoulder having two diameters (or

else including an annular projection which engages the internal diameter of the rim of the article.

23. A thermoforming apparatus as claimed in ~~any of Claims 6 to 9~~ claim 6, characterised in that the said retention means comprises a push-rod which rises from a surface of each template (17) to a respective dummy receiving seat.

24. A thermoforming apparatus as claimed in ~~any of Claims 6 to 9~~ claim 6, characterised in that the said retention means comprises at least one annular recess, in which the free rim of an upturned hollow article (15) abuts and a movable push road (56) for removal of the article (15).